XMM-NEWTON ANNOUNCEMENT OF OPPORTUNITY: POLICIES AND PROCEDURES

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1 Purpose and Schedule

The X-ray Multi-mirror Mission (XMM-Newton) is the second cornerstone of ESA's Horizon 2000 Science Programme, providing an observatory-class X-ray facility. XMM-Newton was launched by an Ariane 5 on 10 December 1999, and has a design lifetime of about ten years.

The observatory provides simultaneous non-dispersive spectroscopic imaging and timing (European Photon Imaging Camera; EPIC), medium resolution dispersive spectroscopy (Reflection Grating Spectrometer; RGS) and optical/UV imaging, spectroscopy and timing from a co-aligned telescope (Optical Monitor; OM).

In combination the three cameras of EPIC offer a large effective area over the energy range from 300 eV to 12 keV, up to 2500 cm^2 at 1.5 keV and $\sim$1800 cm^2 at 5 keV. Each of the two modules of the RGS cover the energy range from $\sim$0.4 keV to 2.2 keV with an effective area of up to 60 cm^2 at 15 Å. Thus, XMM-Newton offers a unique opportunity for a wide variety of sensitive X-ray observations accompanied by simultaneous optical/UV measurements.

The majority of XMM-Newton's observing time is made available to the astronomical community by the traditional route of Announcements of Opportunity (AO), followed by peer review. These Announcements are open to the worldwide scientific community and the observing time they offer is referred to as "Open Time". This sixth Announcement, AO-6, solicits proposals for observations to be carried out in the period between (approximately) May 2007 and May 2008.

Electronic submission of proposals will be required in response to this Announcement. For all matters relating to the proposal the Principal Investigator (PI) is the single point of contact for ESA. After peer review by the XMM-Newton Observing Time Allocation Committee (OTAC), every PI will be informed about OTAC's decision.

The following schedule has been established:

Announcement of Opportunity	28 August 2006
Due date for proposals	6 October 2006 (12:00 UT)
Final OTAC approved programme	late December 2006
Definition of observation details	15 January to 9 February 2007

As soon as the technical details of successful proposals are confirmed by the Science Operations Team, the observations will be made available for scheduling. Thus, execution of observations resulting from the Announcement of Opportunity could start four to five months after OTAC's decision, or in individual cases somewhat earlier, depending on the visibility of a target.

2 Introduction

This document informs potential proposers about the policies adopted, the procedures to be followed for the AO and the interactions foreseen between proposers and the Science Operations Centre (SOC).

The organization of this document is as follows:

An overview of the different categories of observing time is presented in section 3.

The entire proposal process is summarised in section 4.

Details of the proposal submission procedure and evaluation and selection processes are described in sections 5, 6 and 7, respectively.

Some information on proposal enhancement and scheduling of accepted targets is summarised in section 8.

Sections 9 and 10 contain information on data products, proprietary data rights and publication acknowledgment.

Proposers are advised to read all sections of this document carefully; special attention should be paid to sections 5, and 6 and subsection 7.1

3 Observing Time

The majority of XMM-Newton's observing time is made available via Announcements of Opportunity, which are open worldwide. In addition to this "Open Time", there is "Calibration Time" and Project Scientist's "Discretionary Time". Within the "Discretionary Time" the "Target of Opportunity" process allows for observations which could not have been foreseen at the time of the deadline of the Announcement, see section 3.4.1.

This Announcement solicits proposals to be carried out in the period May 2007 to May 2008. All available "Open Time" of this period is distributed via this call, which results in $\sim$ 14,500 ksec total observing time.

"Open Time" observations resulting from this Call for Proposals will be interleaved into the observing schedule, together with a few observations which failed or were not performed during the time period allocated to the previous Announcements of Opportunity.

3.1 Calibration Time

About 5% of XMM-Newton's observing time is required to maintain the calibration and perform health monitoring of the instruments. Calibration observations already foreseen at the time of the Announcement of Opportunity, routine calibration observations, are published.

Calibration observations which could not have been foreseen at the time of the announcement of opportunity are called non-routine calibration observations. Whenever possible, targets required for non-routine calibration observations are selected without generating additional duplications or violations of data rights of accepted observations.

3.2 Guaranteed Time

No additional "Guaranteed Time" has been made available beyond AO-1.

3.3 Open Time

XMM-Newton is operated in a pre-planned manner. Observers are not expected to be present for the execution of their observations. Thus, all observations must be specified in full detail in advance by the proposers.

"Open Time" proposers may apply to use any of the instrument modes described in the XMM-Newton Users' Handbook. The OTAC will consider each proposal

based on its scientific merits without any, a priori, preference for programs of any specific size. There are no restrictions on the duration nor the size of the programs except those set by the technical constraints of the mission, such as, for example, sky visibility.

Proposers for "Open Time" are not allowed to duplicate any of the planned observations and should carefully justify duplications with performed observations (see section 5.10 for the exact definition and further discussion of duplication issues). Proposers for "Open Time" observations should avoid the violation of data rights of planned or performed observations (see section 5.11 for the exact definition and further discussion of this issue). Checks for duplications and violation of data rights will be performed by the SOC during the processing of the proposals.

In total about 90% of XMM-Newton's observing time will be available to "Open Time" observations.

3.4 Discretionary Time

The XMM-Newton Project Scientist can grant "Discretionary Time", which is at maximum $\sim 5\%$ of the XMM-Newton observing time.

All Target of Opportunity (TOO) observations are executed in the "Discretionary Time" of the Project Scientist. Recommendations for TOO observations, which fail the instantaneous selection process of TOOs, are automatically forwarded to the Project Scientist and considered as recommendation for observation in the discretionary time.

The Project Scientist can use his "Discretionary Time" to increase observing time of accepted targets. This does not impact on the data rights nor on the proprietary period of the observation.

3.4.1 Targets of Opportunity (TOOs)

TOOs are astronomical events observable by XMM-Newton, which cannot be predicted and scheduled on the time scale of a year, yet are scientifically sufficiently important to justify interrupting the overall XMM-Newton program. Consequently, TOOs cannot be proposed for any XMM-Newton AO.

Because these events often need rapid reaction times, the overall responsibility lies with the Project Scientist, who coordinates his decision with a chairperson of the OTAC, if time permits. The Project Scientist or his deputy, makes the decision for an interruption of the program.

The possibility to recommend TOO observations is open to all astronomers worldwide. Astronomers who detect a suitable event are strongly encouraged to send a

TOO recommendation via the TOO alert page at:

http://xmm.esac.esa.int/external/xmm_sched/too/too_alert.shtml

Receipt of a TOO recommendation immediately initiates the process of technical review, a decision to interrupt the XMM-Newton programme and, if accepted, the observation of the proposed target.

The XMM-Newton SOC monitors the IAU and the GCN Circulars.

TOO observations which do not violate data rights of accepted targets are made public after successful Observation Data File (ODF) generation. The Project Scientist decides about data rights and the proprietary period of data resulting from TOO observations which are violating data rights of accepted targets, based on the obtained observation and its scientific merits. The originator of a TOO observation is invited to collaborate with scientists of the XMM-Newton SOC in the scientific analysis and interpretation of the data.

Follow-up observations of TOO events which occurred after the deadline of a call are explicitly covered by the policy described above.

4 Overview of Proposal Preparation, Submission and Selection

The proposal process in response to this Announcement of Opportunity is similar to that of the previous calls and, in summary, is as follows. Proposers will have to submit proposals to ESA by the deadline given in Section 1 using the Remote Proposal System (RPS). This system is a version of the widely known HEASARC remote proposal submission system adapted for the specific needs of XMM-Newton. These proposals must contain the scientific justification and some observing details such as target coordinates, scientific prime instrument, and total required observing time. The OTAC reviews these proposals and recommends priorities. Only proposers of successful proposals will be asked to specify full observing details.

Users must perform the following tasks:

- Download the documentation for the Call either via the WWW

  http://xmm.esac.esa.int/external/xmm_science/AO6/

  or via ftp at

  ftp ftp://xmm.esac.esa.int/ (anonymous; "cd pub/AO6")

- Prepare a concise scientific justification for the proposal (pdf file) and a feasibility study of the observations (see also Section 5.7, 5.8 and 5.9). Note that figures can be included in the pdf file.

- Fill in the RPS forms, according to the instructions provided online and use exposure times calculated with the methods described in the XMM-Newton Users' Handbook.

- Verify the proposal through the RPS. This allows

  (a) validate the format of the proposal (completeness, syntax, parameter limits checking), and

  (b) if validation succeeds, production of a file suitable for printing.

- Submit the proposal through the RPS to ESA before the deadline. Both, proposal submission and justification upload must be performed before the deadline.

On receipt of the proposals, the SOC will forward them to the OTAC for scientific review, while performing some technical assessments and preparing overall statistics on the response. The OTAC will assign priorities to each proposal (and, as needed, grade individual observations within a proposal). For details see section 7.3.2.

Only proposers of OTAC approved observations will have to specify all observing details via the 2nd Phase XMM-Newton Remote Proposal Subsystem (XRPS). Detailed instructions will be provided within the e-mail which informs the PI about the OTAC decision.

One of the parameters used to plan which observations will be carried out during a particular orbit, is the priority of the observations as allocated by the OTAC. However, for operational reasons, no guarantees can be given that a particular observation will, in fact, be executed, regardless of its grade.

5 Specific Call Issues

5.1 Remote Proposal System of XMM-Newton

Proposals in response to this Announcement of Opportunity have to be submitted electronically. A two phase submission process will be applied:

Phase 1: In response to the call all proposals have to be sent using the Proposal Submission System (RPS). These proposals must contain the scientific justification and some observing details such as target coordinates, scientific prime instrument, and total required observation duration (including the overhead time of the instruments). The instructions for using RPS are available online.

Phase 2: PIs of observation(s) accepted by OTAC, will have to provide full observation details. This has to be done using the XMM-Newton Proposal Submission Subsystem (XRPS). Instructions and details will be provided via e-mail together with the information about the OTAC decision. Observations for which a PI fails to provide the required observation details in due time will not be performed.

5.2 Proposal Types and Joint Programs

"Open Time" proposals can be submitted as "Guest Observer", "Large Programs", "Triggered Observations", joint "XMM-Newton/Chandra" or joint "XMM-Newton/ VLT(I)" proposal.

The large majority of proposals will fall under the type "Guest Observer". For observations where the schedule time can not be planned in advance, the proposal type "Triggered Observations" has to be selected. Proposers, who want to apply for time of the joint XMM-Newton/Chandra or joint XMM-Newton/VLT(I) program have to choose the corresponding type, either "XMM-Newton/Chandra" or"XMM-Newton/VLT(I)". All six types of proposals are explained in detail below.

5.2.1 Guest Observer

As said above, most of the proposals will fall under the type "Guest Observer". The exceptions are:

- proposals which require a significant amount of observing time, see Section 5.2.2
- XMM-Newton observations which can not be planned in advance because of the physical nature of the source, see Section 5.2.3

- Observations which require observing time from both Chandra and XMM-Newton, see Section 5.2.4
- Observations which require observing time from both VLT(I) and XMM-Newton, see Section 5.2.5

It is not possible to apply for more than one of the offered categories simultaneously. Observations which should be done in coordination with other facilities or satellites, e.g. Rossi XRTE or VLA, fall under the proposal type "Guest Observer". It is recommended that the PI of coordinated proposals carefully reads Section 5.6.

5.2.2 Large Programs

Scientific programs which require a significant amount of total observing time (approximately >300 ksec) and which are deemed to be of major scientific importance may be submitted as "Large Programs". It is the responsibility of the Principal Investigator to identify a submitted proposal as "Large Program" within the electronic submission of the proposal with the RPS.

Such proposals will be highlighted to the corresponding OTAC panel, where they are discussed with respect to the expected return for the scientific category. The panel can reject such proposals, accept them within their own time budget or, alternatively, recommend them to the chairpersons meeting without allocating time from the panel's time budget. Within the chairpersons meeting a special session will be devoted to discuss and compare the recommended "large" programs with respect to their overall scientific return. The amount of time which can be allocated to large programs in the chairperson meeting is at maximum 15% of the time available for the AO.

OTAC can apply the "Large Programs" procedure to every program that asks for a significant amount of total observing time if the scientific case is judged to be of major scientific importance.

5.2.3 Triggered Observations

There are many established (or expected) X-ray sources with known coordinates for which the emission is characterized by unpredictable events, for example bursting high-mass X-ray binaries, novae, cataclysmic variables, etc. Often such events are discovered by general monitoring programs of candidate sources or areas.

Proposals to observe such events with XMM-Newton are permitted. The proposer has to select the proposal type "Triggered Observations". In addition such observations must be submitted as "Fixed-Time" ("Time critical" in RPS) observations, see Section 5.5. Associated with these observations there must be a clear indication

of what triggers the actual observation to be performed. The "Remarks" field in RPS should be used to provide this required information. A request for coordinated observations is not allowed for proposals of type "Triggered Observations".

Given the nature of such events, re-scheduling of the XMM-Newton observing sequence and update of instrument modes is likely to be necessary. Consequently, the observing parameters should be provided on a best guess basis.

To avoid any conflict with a "genuine" TOO recommendation, the PI is responsible for providing all necessary information and updates of the observing parameters immediately after the specified event occurs. In case of a conflict between a TOO and a Triggered Observation proposal, the Project Scientist will decide. The basis of the decision is the information provided, as well as the time at which the information arrived at the SOC.

In contrast to all other types of proposal, for the "Triggered Observations" the OTAC will allocate observing time to the entire proposal and not to individual targets. This offers the possibility to recommend a list of candidates, without specifying which of the sources in the list will finally be observed. OTAC can accept a subset of the candidates. For every source in a candidate list a separate observation form has to be filled-in within the RPS.

5.2.4 Joint XMM-Newton/Chandra Proposals

If a science project requires observations with both Chandra, sponsored by the U.S. National Aeronautics and Space Administration, and the XMM-Newton Observatory, then a single proposal may be submitted to request time on both observatories to the XMM-Newton Announcement of Opportunity, so that it is unnecessary to submit proposals to two separate reviews.

By agreement with the Chandra Project, the XMM-Newton Project may award up to 400 ksec of Chandra observing time. Similarly, the Chandra Project may award up to 400 ksec of XMM-Newton time. The time will be awarded only for highly ranked proposals that require use of both observatories and shall not apply to usage of archival data. The only criterion above and beyond the usual review criteria is that both sets of data are required to meet the primary science goals. Proposers should take special care in justifying both the scientific and technical reasons for requesting observing time on both missions. It is not essential that the project require simultaneous XMM-Newton and Chandra observations. No Targets of Opportunity, either pre-planned or unanticipated, will be considered for this cooperative program. For this solicitation, no Chandra time will be allocated without the need for XMM-Newton time to complete the proposed investigation.

Establishing technical feasibility is the responsibility of the PI, who should review the

XMM-Newton and Chandra documentation (http://cxc.harvard.edu/proposer/POG/index.html) or consult with the Chandra Guest Observer Facility (http://cxc.harvard.edu/helpdesk/). For proposals that are approved, both projects will perform detailed feasibility checks. Both projects reserve the right to reject any approved observation that is in conflict with safety or mission assurance priorities or schedule constraints, or is otherwise deemed to be non-feasible. Note that simultaneous longer-duration observations with XMM-Newton that require Chandra satellite pitch angles that violate restrictions may not be feasible. Any observation(s) deemed to be not performable as indicated above would cause revocation of observations on both facilities.

Scientists can apply for joint XMM-Newton/Chandra program time by selecting the proposal type "XMM-Newton/Chandra". The "Remarks" field, which is offered in the RPS should be used to briefly describe the instrument modes and observing time requests for Chandra.

5.2.5 Joint XMM-Newton/VLT(I) Proposals

With the aim of taking full advantage of the complementarity of ground-based and space-borne observing facilities, ESA and ESO have agreed to establish an environment for those scientific programmes that require observations with both the XMM-Newton X-ray observatory and the ESO VLT(I) telescopes to achieve outstanding and competitive results.

By agreement with the XMM-Newton observatory, ESO may award up to 290 ksec (80hr) of XMM-Newton observing time. Similarly, the XMM-Newton project may award up to 80 hours of ESO VLT(I) observing time. This applies to the duration of an XMM-Newton cycle, which normally extends over two ESO observing periods.

Proposers wishing to make use of this opportunity will have to submit a single proposal in response to either the XMM-Newton or the ESO call for proposals: proposals for the same programme submitted to both observatories will be rejected. Although time is requested on both observatories, it will be unnecessary to submit proposals to two separate reviews. A proposal submitted to ESO will be reviewed exclusively by the ESO's OPC; a proposal submitted to the XMM-Newton observatory will be reviewed exclusively by the XMM-Newton OTAC. Proposals that request different amounts of observing time on each facility should be submitted to the observatory for which the greatest amount of time is required.

The primary criterion for the award of observing time is that both ESO VLT(I) and XMM-Newton data are required to meet the scientific objectives of the proposal. It is not essential that the project requires simultaneous XMM-Newton and ESO telescope observations. Targets of Opportunity and "Triggered Observations" are excluded from this cooperative programme.

It is the proposers' responsibility to provide a full and comprehensive scientific and technical justification for the requested observing time on both facilities. Both the ESO and XMM-Newton observatories will perform feasibility checks of the approved proposals. They each reserve the right to reject any observation determined to be unfeasible for any reason. The rejection by one observatory could jeopardize the entire proposed science programme.

Apart from the above, for both the ESO and the XMM-Newton observatory, the general policies and procedures currently in force for the final selection of the proposals, the allocation of observing time, the execution of the observations, and the data rights remain unchanged.

Scientists can apply for joint XMM-Newton/VLT(I) program time by selecting the proposal type "XMM-Newton/VLT(I)". The "Remarks" field, which is offered in the RPS should be used to briefly describe the instrument modes and observing time requests for VLT(I).

5.3 Planned Targets of Opportunity

It is not allowed to propose unpredictable TOOs only by target category (e.g. γ-ray bursts, supernovae etc.). Potential proposers who can identify suitable candidate objects by the deadline of the Announcement (which means that target coordinates can be provided) are recommended to study section 5.2.3 in detail. Potential proposers who can **not** provide coordinates by the deadline of the Announcement are asked to study section 3.4.1 with great care.

5.4 Large Area Surveys

Large areas of the sky may be observed by XMM-Newton through observations next to each other such that the fields of view of the individual observations touch each other or even overlap. Proposals asking for more than 10 of such observations are called "Large Area Survey". Depending on the amount of total observing time the PI may consider to send the proposal as "Large Program", see section 5.2.2. The PIs are asked to describe the proposed area of the sky in detail within the scientific justification. In the RPS only one observation, that is located at the centre of the proposed area, should be entered. In addition the exposure time of the observation and the number of repetitions have to be selected such that the total number of observations and the total amount of observing time are correct. The details of each observation will have to be defined in XRPS within the phase 2 submission.

5.5 Fixed-Time Observations

A "Fixed-Time" observation ("Time Critical" in RPS) is defined as an observation whose scheduling is not solely determined by its visibility and spacecraft position angle constraints. Examples of "Fixed-Time" observations are:

- "Triggered Observations", see section 5.2.3,
- Observations for which the observer can specify the calendar date, or relative date through, e.g., an orbital ephemeris,
- Observations which must be conducted more than once with a pre-determined time lag in between,
- "Coordinated Observations", see section 5.6.

"Fixed-Time" observations reduce the flexibility available to the mission planning system for scheduling of observations and can lead to larger than nominal slew overheads. Thus, all proposers are reminded that "Fixed-Time" observations should only be asked when there is a strong scientific requirement. This justification must be provided explicitly in the proposal justification. In addition, the scheduling constraints should be described in detail in the "constraints" sub-menu after entering an observation as "Time critical".

It is the responsibility of the PI to demonstrate that proposed "Fixed-Time" observations are visible, see section 5.7.

5.6 Coordinated Observations

Observations of XMM-Newton which should be performed simultaneously with approved observations at other telescopes, like Rossi XRTE, VLT, VLA, require a careful coordination of the planning between two or more Science Operations Centers. Similarly to "Fixed-Time" observations, they reduce the flexibility available to the mission planning for scheduling of observations and often lead to larger than nominal slew overheads.

Observations will be performed simultaneously with other telescopes on a best effort basis. The mission planning will consider requests for simultaneous observations only if the observation was flagged as "Coordinated" at the time of proposal submission and approved as such by OTAC.

It is the responsibility of the observer to demonstrate that a target proposed for "Coordinated Observation" is visible, i.e. that a common visibility window exists (see Section 5.7). It is strongly recommended that targets proposed for coordinated

observations have a sufficiently long common visibility window per revolution (i.e. common visibility window > observation duration + six hours).

5.7 Source Visibility

Observations with XMM-Newton are only possible under a number of celestial constraints, for example Sun, Earth limb, and Moon avoidance angles. As a consequence, not every source is visible at all times. Therefore, it is mandatory that observers study the visibility of a target, in particular if the target should be observed under a specific position angle, on a certain date (see Section 5.5) or simultaneously with other telescopes (see Section 5.6). The XMM-Newton SOC provides a web-based tool which allows an online target visibility check for given coordinates and observation times, the "XMM-Newton Target Visibility Checker". For details see:

http://xmm.esac.esa.int/external/xmm_sched/vischeck/AO6

In order to reach a maximum efficiency, the start time of "Fixed Time" observations should not be constrained below a margin of ±15 ksec (see Section 5.5-5.6).

For large surveys of a particular area on the sky, the observer should ensure that the total requested exposure time does not exceed approximately 40% of the cumulative visibility of the area during the AO (about 15 revolutions for most parts of the sky).

Several scientific questions might be addressed equally well with several different targets or areas on the sky. In this case it is strongly recommended that the proposer selects the target or area with the longest cumulative visibility.

5.8 Feasibility of Observations

The duration of each requested observation has to be estimated and entered into RPS by the proposer. Instructions for calculating exposure times are contained in the XMM-Newton Users' Handbook; the use of software tools (SciSim, XMM-Newton visibility checker, PIMMS) is recommended. The XMM-Newton SOC recommends that proposers base their estimation of exposure times on previous X-ray measurements whenever possible, especially on previous XMM-Newton observations if available. After correction for the different energy bands and effective areas (for example with PIMMS), these give reasonable estimates of the needed exposure times. It is mandatory that observers describe in their proposals how they calculated the exposure times. A realistic estimate of the observing time is a major selection criterion for the OTAC.

PIMMS (Portable, Interactive, Multi-Mission Simulator) allows users to estimate the count rate, hence the exposure time necessary to achieve the scientific objectives of an observation, based on the count rate measured with another instrument, or

a theoretically calculated flux, and an approximate spectral shape. Although it cannot substitute a full spectral or timing simulation with SciSim for data analysis, PIMMS nevertheless provides a useful first-order estimate of the count rate when a proposal is being considered. "First-order estimate" in this context means that the uncertainties of the PIMMS estimates are often (though not always) dominated by the scientific uncertainties regarding the source.

PIMMS for XMM-Newton is officially supported by NASA and is available from HEASARC via the WWW:

http://heasarc.gsfc.nasa.gov/Tools/w3pimms.html

Background radiation affects XMM-Newton observations due to the large collecting area of its mirrors. A proper background subtraction strategy allows to satisfy the original scientific request for the large majority of observations. Scientists proposing observations aiming to detect faintest point-like or extended sources at the technical limit of the instruments, i.e. observations requiring a "zero" background radiation level, or observations aiming variability studies, should propose an exposure time increased by 40% with respect to the calculated value.

The feasibility study of extended sources requires special attention. Proposers should consider that besides the X-ray background also the instrumental background has to be taken into account. Experience shows that in the absolute minimum proposers should provide the background count rate per unit area (count/s/cm^2) and the signal to background ratio required for the most critical region, i.e. the region for which the spectral analysis or deeper source detection is proposed. Proposers should also specify the energy bands to which these numbers are referring.

Experience from previous AOs has demonstrated that the requested exposure time is often significantly underestimated. An estimate of the exposure time based on a "3σ" signal to noise ratio implies a significant (3σ) detection only in 50% of the cases. Many estimates of exposure times are based on a comparison with physically similar targets already observed in the X-ray band. Proposers should be aware that the literature is biased against detections and therefore many reported fluxes are not good representatives for a particular object class, as a whole.

5.9 Proposal Length and Figures

The OTAC encourages all proposers to be as concise as possible in their proposals. Use of graphical material (figures, diagrams, examples of data, etc.) is encouraged whenever it helps the OTAC to draw conclusions on the scientific merit of the proposal. The scientific justification must be prepared as a single pdf file. The size of the (uncompressed) pdf file should not exceed 10 M byte. In total four pages are allowed for the scientific justification of standard programs, including all

accompanying material, like the graphical material, a section on the feasibility of the proposed observations (Section 5.8), tables and references. In total five pages are allowed for the scientific justification of "Large Programs" (Section 5.2.2), including all accompanying material. The minimum allowed font size is 11 pt. Non-compliance with these instructions will lead to the outright rejection of the proposal. The usage of the provided Latex template to write the scientific justification is mandatory. The Latex template is provided at:

http://xmm.esac.esa.int/external/xmm_science/AO6/.

The RPS on-line help gives further details on how to send the scientific justification (pdf file) during proposal submission.

5.10 Duplication and Reserved Observations

The general policy of the XMM-Newton Observatory is to avoid repeating the same observation, i.e. to avoid duplications.

In general, a duplication is determined by consideration of the target coordinates and of the main observing parameters (especially the instrument(s) and the observing modes). A proposed observation duplicates another one if the expected science data are essentially the same or of lower quality (e.g. lower exposure time). It is, for example, allowed to observe the same target with the same instrument configuration several times for variability studies. On the other hand, observations of hard X-ray sources with EPIC using different filters only (which mainly affects the soft energy response) may be classified as a duplication.

The responsibility for defining and resolving cases of duplication rests with the OTAC in consultation with the Project Scientist as needed. Within a single observing cycle, duplications are forbidden. The OTAC can allow duplications between a proposed observation and an observation of a previous cycle. These should be restricted to proposals which provide convincing evidence that additional data are of scientific relevance and that the scientific case cannot be fulfilled with the existing data.

All observations which are not considered as being successfully observed, as well as the calibration observations already foreseen at the time of the announcement are made public for each Announcement of Opportunity. Proposals in response to this call are not permitted to duplicate these observations. Proposers are requested to check for duplications of their preferred targets against already performed or planned observations, using the XMM-Newton Observation Lokator tool. This tool includes all types of XMM-Newton observations like guaranteed, open, TOO and calibration.

5.11 Violation of Data Rights

In general, a violation of data rights is determined by considering the coordinates, the target, the proprietary period and the scientific questions raised. A proposed observation will violate the data rights of a performed or planned observation if it has the potential to address scientific questions of the performed or planned observation on the same sky field within its proprietary period.

It is the general policy of the SOC to solve violation of data rights by delaying observations or by holding back the delivery of datasets. Potential proposers should carefully check the planned and performed observations.

6 Proposal Submission Procedure

6.1 Proposers

This XMM-Newton Announcement of Opportunity is not restricted to proposers in member states of the European Space Agency. Proposers from all over the world are welcome to participate.

6.1.1 US Proposers

Proposers at institutions in the United States may respond to this AO either as PIs or as Co-Investigators on foreign-PI proposals. Funding will be made available by NASA to accepted US investigators through a separate solicitation. Details regarding the deadline, content, and target funding level for cost proposals will be distributed to successful proposers within roughly one month of the ESA selection.

6.2 Submission of Open Time Proposals

XMM-Newton proposals must be prepared using RPS provided by ESA. This tool checks for the formal correctness of the proposal's entries. It produces formatted text output in electronic form. Proposals in **any** other format will not be accepted.

For technical details and advice, please see on-line instructions:

http://xmmrps.esac.esa.int/

For each observation contained in the proposal, the total observation duration which includes the overheads of the instruments is considered by OTAC. In order to calculate this time, proposers have to enter the requested science exposure time of the scientific prime instrument and the prime instrument mode in the RPS.

Submission of a proposal is only complete if:

1. the validated RPS file of the proposal (i.e. the file produced by RPS when no formal errors are reported) is received before the deadline of the call and

2. the scientific justification is received before the deadline of the call.

In view of possible network congestion close to the deadline, proposers are urged to submit their proposals well in advance of the due date. Proposers will receive an e-mail acknowledgment confirming the receipt of their proposal(s) and providing the proposal number assigned after successful submission.

7 Proposal Evaluation and Selection

7.1 Valid Proposals

Proposals submitted in response to a call are considered valid if

- the submission was completed as defined in section 6.2,
- the proposal is in agreement with the policies and procedures described in this document.

Within a proposal, individual observations are considered valid if

- the observation was entered in the RPS,
- the observation is in agreement with the policies and procedures described in this document,
- the target is visible during the period covered by the call.

Any information becoming available after the due date for proposals can not be considered for the proposal evaluation.

By the submission of a proposal, the PI as well as all Co-Investigators are accepting the policies and procedures described in this document. In case of doubts about the interpretation or in case of unforeseen conflicts, the final decision stays with the XMM-Newton Project Scientist.

It is the obligation of the PI to inform the SOC about every change which potentially impacts on the enhancement, the scheduling, the observation or the data distribution. Especially, the SOC should be informed about any change of the electronic address of the PI via e-mail to xmmpi@sciops.esa.int and writing the proposal number in the subject of the e-mail.

7.2 Proposal Handling at the Science Operations Centre

The receipt of each incoming proposal will be automatically acknowledged. A check will be made to verify that it is a valid RPS input file.

The valid proposal will then be forwarded to the appropriate panel members of the OTAC for scientific assessment and review.

The electronic versions will be ingested into a proposal data base for statistical analysis. Also, some investigations will be performed to search for, amongst others, duplications, violations of data rights, instrument safety, oversubscription in particular areas of the sky, technical feasibility.

Every proposed target will be checked with respect to performed and planned observations of XMM-Newton and Chandra. Targets which duplicate previous observations or planned observations of one or of both missions will be flagged for the OTAC evaluation. Therefore, a detailed analysis of the scientific content of existing X-ray data with respect for the scientific goal of a submitted proposal is highly recommended.

7.3 Scientific Review

7.3.1 Observing Time Allocation Committee

All "Open Time" proposals will be reviewed by the OTAC. This committee is appointed by the Director of ESA's Scientific Programme. It is headed by a chairperson and consists of one to three panels for each of the following scientific categories:

1. Stars, White Dwarfs and Solar System
2. White Dwarf Binaries, Neutron Star Binaries, Cataclysmic Variables, ULXs and Black Holes
3. Supernovae, Supernova Remnants, Diffuse (galactic) Emission and Isolated Neutron Stars
4. Galaxies and Galactic Surveys
5. Active Galactic Nuclei, Quasars and BL-Lac Objects
6. Groups of Galaxies, Clusters of Galaxies and Superclusters
7. Cosmology, Extragalactic Deep Fields and Area Surveys

Each panel consists of 5 members (including the panel chairperson).

7.3.2 Review Process and Selection Criteria

The OTAC will review the "Open Time" proposals and will make recommendations on the observing program to be carried out by XMM-Newton. The following items will be taken into account during the review process:

- scientific case and justification,
- scientific merit and relevance of the proposed observation(s),
- contribution to the overall scientific return of XMM-Newton,
- duplication with performed and planned XMM-Newton and Chandra observations
- technical feasibility and exposure time estimation,
- visibility and requested observing time.

The recommendations on XMM-Newton's observing programme are made via assignation of one of three scientific priorities to every individual observation: A, B and C (A being the highest ranking). In addition, the OTAC

- is responsible for defining and resolving cases of duplication,
- has the right to recommend exposure times either for entire proposals or for individual observations,
- decides about the acceptance of observing constraints.

For efficient timelining of observations, the scientific scheduling software needs to work from a pool of observations which significantly overfills the time available. Thus, the recommendations mentioned above will take into account the provision of the necessary oversubscription in the data base of planned observations. Priority A and B targets are of major scientific importance and will be scheduled with highest priority. Priority C targets are used as "fillers" and have a significant lower likelihood to be finally scheduled. The fraction of priority C targets which are expected to be observed can be estimated from the statistics in previous AOs. The interested scientist may consult the "XMM-Newton Quarterly Status Report" in the XMM-Newton web site.

It is planned that (without further review by the OTAC) A and B targets will be transferred to the next observation period, if their successful observation should not be possible during the current one. "Fixed-Time" proposals from this AO which are no longer technically feasible in the following observing period will not be carried

forward. C priority targets that have not been observed by the end of the AO will not be transferred into the following AOs and therefore will be freely available for new proposals. However, it is emphasized that, for operational and technical reasons, no guarantee can be given that any particular observation will, in fact, be executed.

Titles and abstracts of accepted proposals will be made publicly available.

8 Enhancement, Scheduling and Observation

8.1 Enhancement of accepted Observations

Before an XMM-Newton observation can be released for scheduling, several checks must be completed to ensure that the proposed instrumental configuration is safe and adequate for the scientific proposal goals. This process is called proposal enhancement. Only after the proposal enhancement process is successfully completed, an XMM-Newton observation can be released for scheduling. The PIs of accepted observations which can not be performed as requested through the XRPS will be contacted by the XMM-Newton SOC at the most appropriate time, to start the enhancement process.

During the proposal enhancement, changes of observations are allowed as long as they are in agreement with the scientific justification of the proposal. The proposed prime instrument is considered to be a substantial component of the scientific claim. Changes leading to unforeseen duplications or violations of data rights are not allowed. Based on the submitted proposals, the Survey Science Center (SSC) consortium will set up an intricate program of optical follow-up observations, and will have been awarded time on ground based telescopes for such proposals. Therefore changes of the permission for SSC follow-up cannot be made after the XMM-Newton proposal approval stage.

8.2 Planning and Scheduling of accepted Observations

The planning and scheduling of XMM-Newton observations is a work-intensive and complex process. The goal of this process is to maximize simultaneously the scientific return and the observation efficiency.

The planning and scheduling has to take into account the visibility of the targets, scientific constraints, times with expected high radiation background, handover between ground-stations and feasibility of slews. Observations with XMM-Newton must comply with a number of celestial constraints, such as solar, Earth limb, Moon or Jupiter avoidance angles. Examples of additional scientific constraints are specific spacecraft position angles, "Fixed-Time" observations, "Triggered Observations", or requests for simultaneous observations. Depending on the solar activity, a part of the science window at the start and at the end of an XMM-Newton orbit can be affected by a high radiation background, which forbids opening of the filters of the EPIC camera. During the handovers between the different ground-stations used in each XMM-Newton revolution, observations can be continued but commanding or slewing is not possible. Even if a target is well visible according to the visibility constraints, it may not be reachable from the perigee position at the start of a revolution, because the slew would violate some of the constraints mentioned above.

Other targets may not be scheduled because the slew back to the perigee position is forbidden.

Whenever possible, the priority of an observation as allocated by the OTAC is considered for the mission planning and scheduling. However, for operational reasons, no guarantees can be given that any particular observation will, in fact, be executed, regardless of its grade.

The SOC prepares the final detailed timeline about 3-4 weeks in advance. Given the various constraints, listed above, the mission planning and scheduling team can not avoid that some observations are split in multiple parts. Additionally, the actual performance of the instruments and the corresponding observing modes are taken into account, i.e. requested observing modes may be replaced by a similar but better one based on the performance reports from the instrument teams.

The PIs are automatically informed via e-mail when their observation is scheduled. It is the responsibility of the PI to check carefully the scheduling details within three days and report about any observation which is not in agreement with the enhancement or the rules and procedures in force. After three working days, the SOC assumes that the PI agrees with the implementation of the observation. It is the PI's responsibility to communicate the SOC any change of her/his e-mail address, by e-mail to xmmpi@sciops.esa.int with the proposal number in the subject line.

8.3 Observation

XMM-Newton is operated in a pre-planned manner. Observers are not expected to be present for the execution of their observations.

Depending on the unpredictable activity of the Sun, e.g. solar "flares", the start of the execution of scheduled observations may have to be manually delayed or stopped earlier than originally planned in the timeline.

8.4 Success of Observations

The Project Scientist is responsible for declaring a particular observation successful.

Observations are declared successful based on the accumulated observation time according to the following rules:

1. The accumulated exposure time of the prime instrument is greater ($\geq$) than 80% of the requested observing time.

2. The accumulated exposure time of non-prime instruments is greater ($\geq$) than 60% of the requested exposure time.

3. For structural identically instruments all calculations are performed for all instruments together.
   RGS-1 and RGS-2 are evaluated together and have the same weight. MOS-1, MOS-2 and pn are evaluated together for EPIC and the two MOSs have the same weight. The higher effective area of pn relative to MOS-1 and MOS-2 is reflected through a weighting factor of two for pn exposure times.

4. Exposure time of non-prime instruments lost for operational or safety reasons (e.g. radiation alert) is only counted if the exposure is crucial for the science originally addressed in the proposal.

5. Radiation induced background is not taken into account.

All observations for which no compensation time is allocated are considered as successfully observed.

The SOC automatically allocates compensation time for observations which have not been successfully performed or which have not been completed fulfilling the above rules. The compensation time is calculated through comparison between the accumulated and allocated observing time. The requested observing time is given by the exposure time requested by the PI in the original proposal, but not exceeding the total time allocated by OTAC, for those observing modes which are not violating security or technical constraints of the instruments or the spacecraft.

The compensation time should significantly increase the signal-to-noise ratio of the data already obtained and is crucial for the science originally addressed in the proposal, e.g. the compensation time should exceed 5 ksec.

These rules may be illustrated with the following examples:

- Taking rule 3 into account, 60% of the requested observing time accumulated for RGS-1 and 105% obtained for RGS-2 fulfills rule 1 for RGS prime
  $(60\% + 105\% = 165\% > 160\% = 80\% + 80\%)$

- Taking rule 3 into account, 50% of the requested observing time accumulated for pn, 80% obtained for MOS-1 and MOS-2 fulfills rule 2 for EPIC secondary.
  $(2.0 * 50\% + 80\% + 80\% = 260.0\% > 240\% = 2.0 * 60\% + 60\% + 60\%)$

- Taking rule 4 into account, 0% of the requested observing time accumulated for RGS fulfills a proposal which aims at the detection of a weak source with EPIC (RGS not prime).

- Taking the rule of compensation time into account, 3 ksec missing observing time fulfills an observation aiming at a long (140 ksec) variability study.

The Project Scientist can request a complete repetition of a partly performed observation if a continuous uninterrupted observation is essential for the scientific goal. In this case the Project Scientist decides about the data rights of the data taken during the partly performed observation.

9 Data Products

The data from each observation undergoes pipeline processing at the SSC, which produces a set of standard products for each observation. These products are available in the XMM-Newton Science Archive. Currently 80% of the data are available on a timescale of a few weeks after the observation has been carried out. The PI of each observation is informed immediately after successful pipeline processing via e-mail using the address provided via the XRPS. The associated appropriate calibration and auxiliary files can be obtained from the SOC web site. All products are kept in the XMM-Newton Science Archive and are made publicly available after expiration of the proprietary period (see section 10).

The data products reflect the state-of-the-art of XMM-Newton data analysis at the date of their production. However, subsequent improvements of the pipeline products and the corresponding calibration and auxiliary files are to be expected. In order to allow observers to benefit immediately from the improved understanding of the instruments, calibration files (as well as updated versions of the Scientific Analysis Software (SAS)) are made public on the SOC web-pages. This allows every observer to reprocess her/his data.

Following the notification that the data products are available, observers are responsible for further data processing as well as for the scientific analysis, interpretation and publication of their observations.

10 Data Rights and Publication

For individual observations, there is a proprietary period of 1 year during which, subject to the caveat below, the data from an observation will only be made available to the PI of that proposal. After this period, the data are available to the community. The proprietary period starts at the time when the data are made available to the PI of the proposal in a usable form, i.e. suitable calibration and appropriate data processing being available.

The Project Scientist decides about data rights of partly performed observations for which he has requested complete repetitions.

This is modified for proposals, which consist of more than one observation of a single target, e.g. repeated observations for variability studies. For all data, which are delivered within the observing cycle, for which OTAC has accepted the proposal, the proprietary period of 1 year starts when the last (part of the) data has been made available to the PI. Data, which are delivered after the end of the observing cycle, for which OTAC has accepted the proposal, are treated like individual observations, i.e. each data set gets (individually) a proprietary period of one year.

The end times of the previous observing cycles are:

- AO-1: 1st of January 2003
- AO-2: 1st of January 2004
- AO-3: 1st of April 2005
- AO-4: 1st of May 2006
- AO-5: 1st of May 2007 (TBC)

The PI retains the proprietary rights for the whole dataset in a proposal if no other recommendation was given by the OTAC. In the XRPS, the proposers may also select the option "SSC follow-up". By doing so, they allow the XMM-Newton Survey Science Centre to conduct follow-up observation of the serendipitous source content in the EPIC field of view (for details see: XRPS Proposers Guide and the XMM-Newton Users Handbook). The overall goal of the SSC follow-up programme is to support the community's access to, and exploitation of, the serendipitous data from XMM-Newton, and as such all the results will be made public through the XMM-Newton Science Archive. Except where there are alternate plans to conduct a follow-up programe based on the serendipitous X-ray source content of their XMM-Newton fields, proposers are encouraged to select the "SSC follow-up" option in XRPS.

Data taken during a slew of the spacecraft become directly available to the community, as long as data rights are not violated. Slew data which overlaps with data of either the previous or the next accepted pointed observation in sequence (i.e. during the start and end of a slew) become public after the proprietary period of the performed or accepted observation has expired.

In accordance with ESA's rules concerning information and data, ESA retains the right to use any data obtained by XMM-Newton for instrument evaluation, diagnostic and calibration purposes, while maintaining scientific confidentiality during the proprietary period. ESA also reserves the right to use any data for public relations purposes; in this case, due acknowledgment shall be given to the PI of the proposal and to the PI of the consortium that built the instrument.

Each publication using XMM-Newton data should include the target name, the date of the observation and the observation-ID to ensure that the data can be uniquely identified.

Any publication based on data from XMM-Newton observations shall acknowledge that fact by a footnote, preferably on the initial page in the paper:

"Based on observations obtained with XMM-Newton, an ESA science mission with instruments and contributions directly funded by ESA Member States and NASA".